

Chlorine & Chloramines

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Chlorine & Chloramines

- Kill harmful microorganisms
- Excessive levels can cause eye/nose irritation, stomach discomfort, and anemia
- React with Natural Organic Matter (NOM) to form harmful DBPs



MRDLs

Chlorine & Chloramines MRDLs = 4.0 mg/L

- Applies to all CWSs and NTNCWSs that add chlorine or chloramines
- MRDLs are like an MCL but for disinfectants
- Ensures adequate disinfection
- Flexible - keeps disinfectant levels low enough to minimize DBP formation and limit health effects

Monitoring

- Chlorine and chloramines monitoring based on monitoring for the Total Coliform Rule (TCR):
 - Frequency based on population served
 - Occurs at same locations as TCR sampling in distribution system

TCR Monitoring Schedule*

Population Served	Number of Monthly Samples
25 - 1,000	1
1,001 - 2,500	2
2,501 - 3,300	3
3,301 - 4,100	4
4,101 - 4,900	5
4,901 - 5,800	6
5,801 - 6,700	7
6,701 - 7,600	8
7,601 - 8,500	9
8,501 - 12,900	10

* See rule for larger population categories

Monitoring

- Systems must monitor for chlorine and chloramines every time they sample for total coliform
 - Includes repeat total coliform monitoring
 - Includes reduced TCR monitoring
 - Must be taken at same location as TCR samples

1 TCR sample = 1 chlorine or chloramines sample

Calculating Compliance

- Calculated each quarter using monthly averages
- Based on Running Annual Average (RAA) of monthly averages
- Any RAA of monthly averages that exceeds the MRDL is a violation



Calculating Compliance

Calculating monthly averages

Example:

- System serves 2,785 people
- Samples 3 times per month
- Results for 1 month: 2.1, 3.2 & 1.5 mg/L

$$\text{Sum} = (2.1 + 3.2 + 1.5) = 6.8 \text{ mg/L}$$

$$\text{Monthly Average} = 6.8 / 3 = 2.3 \text{ mg/L}$$

CALCULATION 1

Calculating Compliance

Use last 12 monthly averages to calculate RAA for that quarter.

$$\text{Sum of 12 monthly averages: } (2.3 + 2.0 + 3.1 + 1.2 + 1.6 + 1.8 + 2.4 + 2.0 + 1.2 + 2.7 + 3.2 + 1.9) = 25.4 \text{ mg/L}$$

$$\text{RAA is calculated by } (25.4 / 12) = 2.1 \text{ mg/L}$$

$$\text{RAA of } 2.1 \text{ mg/L} \leq \text{MRDL}$$

CALCULATION 2

Special Calculations

Collect additional samples when required by additional TCR monitoring

- System takes 3 routine TCR and chlorine Samples per month.
- System must take additional TCR samples because 1 TCR sample is TC-positive.

- System must take 3 repeat TCR samples and 3 additional chlorine samples.
- Results of chlorine samples: 1.5, 1.8, 1.6, 2.3, 2.5 & 2.7 mg/L (3 routine & 3 additional)

$$\text{Monthly Average} = (1.5 + 1.8 + 1.6 + 2.3 + 2.5 + 2.7) / 6 = 2.1 \text{ mg/L}$$

Special Calculations

Failure to collect the minimum number of monthly compliance samples = monitoring violation

- System fails to sample 1 month; uses available results
- All compliance samples should be included in the monthly average.

- Sum of monthly averages available from past 12 months: $(1.4 + 2.0 + 1.1 + 2.2 + 1.9 + 1.6 + 2.2 + 2.1 + 1.6 + 2.3 + 1.5) = 19.9 \text{ mg/L}$

$$\text{RAA is calculated by } (19.9 / 11) = 1.8 \text{ mg/L}$$

$$\text{RAA of } 1.8 \text{ mg/L} \leq \text{MRDL}$$

Returning to Compliance

Options for systems with compliance problems:

- Best Available Technology (BAT)
- Source water changes
- Partnership with other system(s)

